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ABSTRACT

Papers on library and information networks which were presented at the 1982 International Federation of Library Associations (IFLA) conference include: (1) "Introduction to the Open and Closed Networking Concepts" by R. M. Bennett (Canada), which differentiates between space-biased and time-biased communications media, relates these concepts to those of open and closed networks, and reviews statutory/regulatory, institutional, and technical aspects of telecommunications networks; (2) "The Dutch Pica Library Automation Network," a description by L. Costers (Netherlands) of the Pica Shared Cataloguing and other Dutch library network systems, and the expected development of a Dutch national automation network; (3) "Pilot Implementation of an Open Library Network Concept in Canada," a discussion by Cynthia J. Durance (Canada) of the Canadian library network environment and the development of a pilot information transfer project for joint cataloging, information provision, and interlibrary lending by the National Library of Canada and five other institutions using an iNet Gateway trial service mounted by the TransCanada Telephone System; and (4) "Problems Related to Interlinking Online Interactive Library Networks" by Frederick G. Kilgour (United States), which considers 48 discrete problems--of which 12 stem from international activity--of the inter-linkage of two library networks for the purposes of shared cataloging, online union catalogs, and interlibrary lending. (ESR)

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PAPERS

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INTRODUCTION TO THE OPEN AND CLOSED NETWORKING CONCEPTS

by

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Meeting
109 SI

ABSTRACT

Introduction to the Open and Closed Networking Concepts

Telecommunications carriers generally offer services classified as either public switched network services or private leased circuits. The original concept of closed networks was derived from private leased circuits and that of openness from the public networks. Since public switched data networks were introduced, these concepts have taken on a different significance. The concepts are clarified and related to such factors as flexibility, privacy and regulatory environment. References made to several telecommunications milieux including Canada.

Ladies and Gentlemen:

It was a privilege to have been invited by the Chairperson for the Section on Information Technology, Henriette Avram, to provide an overview of the two papers which follow. In her letter, she generously spoke of the benefit which would be derived from my "expertise". In acknowledging the invitation, I warned her that I can no longer claim to be an information technology specialist but am now really a generalist. And, what is regarded in some circles as even more remote from expertise, have become a telecommunications policy adviser.

On reflection, I decided that this wasn't too bad a position from which to introduce the two papers. As you know, Cynthia Durrance is going to speak about open systems and Look Costers about closed systems. Now if there is one thing that a telecommunications policy adviser must develop in this age of accelerating technological advancement, it is most certainly a sense of balance. One of my respected colleagues so constantly used the expression ... on the one hand there are those factors, but on the other hand there are these ... that he permanently altered the Cartesian thinking of my engineering background. Consequently, as we approach the main features of this session, I can comfortably suggest that purely open and purely closed approaches may be a nice theoretical point of departure, but there may be a position somewhere between them which has some attraction.

Let me illustrate by suggesting how some of the words which will be used over and over again in this session depend upon your point of view. How many hundreds of times has someone said "I have an open mind on this or that topic" and the audience thinks, "how could anyone be so prejudiced, so narrow-minded, so closed-minded". And then we note that in someone's biography their life is an open book, except there are almost always some closed chapters. The casual way we use the words open and closed in ordinary affairs should warn us to be very careful about how we use the terms in a complex technical field where a common perception of their definition may become very important.

The other word we will be using, "network", has a somewhat paradoxical background. Now, on the one hand, for man the original network was undoubtedly the natural one spun by a spider. Man recognized its value and copied it for catching animals and birds and fish. The whole idea was to have a device, a system, into which something could enter but from which it could not escape. Certainly, conceptually, a closed system. And, strangely enough, many of the first networks that came to my mind as I prepared for this occasion - old boy networks, now supplemented by women's networks, and underground networks - certainly do have a closed connotation.

On the other hand, I am sure we would nearly all agree that the most important networks today - highways, television, telephone, data - are all aimed at providing access, at extending rather than limiting the range of human contact and experience. These networks are as near to being ubiquitous - that is existing or being everywhere at the same time; constantly encountered - as anything which human beings have ever created. The very epitome of openness.

So we have networks intended to constrain and others intended to expand activity. We will have to be careful with this word "network".

As I developed the preceding ideas for this paper, it occurred to me that I had better re-check the definition of some of the words being used. Reaching for the dictionary and opening it about the right place to find "network", it separated at a page whose last word was "meliorism". This was a word I didn't know and I glanced to the bottom of the page to learn its definition. It was almost a psychic experience: "meliorism, noun, the belief that the world tends to become better and that man can aid its betterment". How appropriate to the present situation - because librarians, library scientists and information technologists believe they can aid in the betterment of the world through the services and facilities which they develop and offer to people everywhere. What is the best way to achieve this betterment - open or closed systems?

On that note, let's move on to think very broadly about communications and then to home-in on some of the important factors and issues which affect the use of telecommunications for library applications.

It is often the case that a country's prophets are better known or respected in other lands than in their own. Perhaps one such person is Harold Innis, an eminent economics professor of the University of Toronto whose work is enjoying a resurgence of interest and respect among Canadian scholars and in the professional community. In the decade or so of his life just prior to his death in 1953, he concentrated on the significance of communications in the development of civilizations and the economic growth of nations.

William Melody of Simon Fraser University, co-author of a recent book entitled "Culture, Communications and Dependency - The Tradition of H.A. Innis", summarizes some ideas by Innis which seem to me appropriate to this discussion.

Dr. Melody points to an Innis observation that any medium of communications is "biased" in terms of its tendency to favour control over extended periods of time or over an extended geographical space. Innis argued that the media used in ancient civilizations, parchment, stone and clay, were durable and difficult to transport. These characteristics are conducive to control over time but not over space. These media are time biased. On the other hand, paper is light, easily replicated, and easily transportable with reasonable speed. It is spatially biased: it facilitates administration over great distances and contributes to the geographical extension of empire (in a general sense).

In cultural, terms according to Innes, time-biased communications media are associated with traditional societies that emphasize custom, continuity, community and the historical. They are characterized by stable, hierarchical social orders that tend to stifle individualism as a dynamic for change. Information tends to be limited to a privileged elite and to the use of rich oral traditions.

Space-biased communications media, on the other hand, have an orientation towards the present and future, the expansion of empires, an increase in authority at the centre, and the growth of science and technology. They are characterized by the establishment of systems of information exchange and mass communications that are extremely efficient but which cannot convey the richness, diversity and elasticity of the oral tradition of a time-biased society. The modern media of print, telephone, radio and television, by Innes' terms, are all space-biased.

Melody, in his analysis, goes on to note that today the rapid development of communications technologies, such as satellites, computers, and sophisticated terminals, makes possible instantaneous communications throughout the world and into space itself. Modern technology indeed has introduced, he notes, a powerful spatial bias into modern communications.

However, I think we should look rather carefully at the inclusion by Melody of computers in the list of facilities contributing to this spatial bias. A position could be supported on one hand that the centralized main-frame computer has many of the characteristics of a time-biased system. While telecommunications and mini-computers have changed the picture somewhat, the tendency of a central computer is nevertheless to promote hierarchical structures, to limit access to a few, to stifle individualism as a dynamic for change. One might even suggest that the emphasis of massive central computer data banks is on the historical and that their applications level programs have the same qualities as customs and tend to become sacred - not least because of the cost of change.

On the other hand, the mini-computer, disseminated through all levels of business and educational institutions and in people's homes, is a space-biased technology. In the colloquial expression, everyone can do their own thing. The device is efficient and flexible, responsive to an individual's initiative. It can be readily connected to other mini-computers and to main-frame computers to acquire information or to support the individual's activity or dialogue. Consequently, a system built around a central main-frame would seem to be time-biased whereas the mini-computer based system is space-biased.

I mention these things because in my own mind I find parallels between the concepts of closed systems and time bias, on the one hand, and between open systems and space-biased communications, on the other. The former pairing seems to me to imply a degree of introspectiveness, of possessiveness and, if I may be provocative, of elitism; while the latter pairing, that is open systems and space bias, has an outgoing tone, implies co-operation and accessibility to all who have an interest. So, when we talk to-day about open and closed systems, are we going to be thinking narrowly in terms of the configuration of the computer/communications network to handle a particular library application? Or, will we be thinking broadly in terms of a wider scope, audience and character for the services which you aim to provide? The whole field of networks is in such a dynamic state of development that doors are opening to virtually any purpose and conceptual approach one could wish.

And now perhaps it is time to move on to some thoughts on the telecommunications networks which, in my view, are important to consider. These thoughts fall into three categories:

- Statutory/Regulatory
- Institutional
- Technical

It is worth focusing on these three because, in common parlance, open and closed are usually considered only in terms of the last - that is, the technical.

Let me use Canada as an example in each of these categories because in some ways it is a microcosm of the world situation. Likely during this conference, either in sessions or in the halls, you have already learned something of the geopolitical structure of Canada. There is a Federal Government whose Minister of Communications has a responsibility to promote the establishment, development and efficiency of communications systems for Canada. The earliest voice communications was introduced by Bell Canada, which operates under a special Act of the Government of Canada which permits it to do so anywhere in Canada. But, in practice, it carries on its business only in the Provinces of Ontario and Quebec and in part of the Northwest Territories. British Columbia Telephone also has a special Act of the Government of Canada but operates only in British Columbia. Both Bell and B.C. Tel are private shareholder-owned companies. Telesat, the only Canadian domestic satellite carrier, operates under a federal statute as does Teleglobe, our international carrier.

The telecommunications divisions of our two principal railways, Canadian National and Canadian Pacific, recently formed a partnership. As you can imagine, they were the first to offer nation-wide telegraph and later telex service which could be regarded as the progenitors of data communications. Because they are national railways, they operate under federal legislation.

In all provinces, there is provincial legislation dealing to a greater or lesser degree with telecommunications carriers. The three Prairie Provinces have carriers which are Crown corporations - that is, they are owned by the provincial government through corporations which are more or less independent of government direction. Many of you will compare this to the PTT's operations in your own countries. In the remaining provinces, the Atlantic Provinces, the telecommunications carriers are again private stockholder-owned companies but operating under provincial legislation. Now just so I won't be rebuked by Canadian colleagues, I should note that throughout this description, I have taken some liberties in order not to absolutely confuse you. I hope you are at least somewhat confused by this diversity because if you aren't, the coming punch-line isn't going to work.

Anyway, you can undoubtedly appreciate that, arising from this multiplicity of statutes, there are some differences in philosophies about customer networks and the degree of openness or closedness which will be permitted. Let us take terminal attachment and interconnection as examples. Terminal attachment refers to the connection of devices to the network of the telecommunications carriers. Interconnection is the connection of the facilities of one telecommunications carrier to those of another carrier at any point in the system. The federal statutes are such that attachment and interconnection involve regulatory decisions but the Canadian Government has expressed the policy position that it favours a degree of competition (which attachment and interconnection promote) except for the family of monopoly telephone (voice) services. This philosophy directly affects only the federally-chartered carriers. At the provincial level, the philosophies cover the full range of possibilities from a laissez-faire approach to attachment and interconnection, to a statutory prohibition on terminal attachment and the advertising of products which can be attached. Interconnection of systems for delivery of the family of competitive services has not been achieved anywhere between competing carriers except in areas where federal statutes and regulation prevail. Depending upon your point of view, it is either a demonstration of the genius of Canadians for accommodation or our unmitigated good luck that we are nevertheless blessed with one of the most modern and effective telecommunications systems anywhere in the world.

Now I suspect that somewhere in this mélange there will be a situation which compares to that in your country or between your country and one with which you might wish to establish a library network. Fairly clearly there can be some real statutory or regulatory issues on whether your network could be truly open or closed or any combination of the two.

Let us move now to the institutional considerations which might affect a proposal to establish an open or closed network. In Canadian federal law, a statute is to be regarded, unless specifically constructed otherwise, to be remedial, that is as being, broadly speaking, corrective and not restrictive or compulsive. Consequently, even where federal statutes permit terminal attachment or system interconnection, the institutions themselves are not prohibited from setting up policy constraints which either inhibit or prevent it happening. In our system, there are generally mechanisms for a person to seek relief from such constraints by requesting the regulator to order interconnection or attachment. These processes are happening frequently, but it does take initiative and effort to alter or offset the policy of the carrier.

In countries where there is only one telecommunications carrier providing network services, the concept of openness may not be seriously impaired by statutory regulation or institutional constraints. However, in a country like Canada with two carrier groups, some members of a library community who want to establish a network may prefer one of the competing carrier group and other members prefer the other carrier group. You really have to ask whether the concept of openness is possible if there is an institutional, statutory or regulatory prohibition on interconnection which forces all members towards one carrier group or the other. Similarly if terminals which can be attached to the public switched networks in one jurisdiction are in some way limited by the telecommunications carrier in another, there would be a question of the true "openness" of the system. And so, as we now move on to the technical networking aspects, let me just leave the thought that there are many elements to be recognized and there may be important issues to be resolved in the statutory, regulatory and institutional fields which affect our topic of openness or closedness. They are too often not recognized or addressed in discussions of this sort although you, who are library executives and managers, perhaps should be influencing public policy on them.

Now on to the technical, which most of your probably regard as the source of the real issues in this debate. Out of deference to my earlier remarks that I am not a technical expert, I had better be quick about this so we can get on to the double-bill main features on the subject.

At the technical level, we should recognize that most telecommunications networks were historically organized to provide two broad classes of service. Firstly, we have public switched network services, originally voice then telex and later data. Secondly, we have the private leased services. The very nature of these networks defines a regime of openness in the former case and of closedness in the latter. More recently a new concept, particularly introduced in digital data communications systems, has in a way bridged the two

classes. This is the closed user group. Such groups use the digital switches and transmission facilities of the public switched network but the system is programmed so that they can carry on communications among themselves without access or intervention by anyone outside the group. Alternatively they can individually exchange communications with parties outside of the group who are on the public network. So we are back to one of our paradoxes - an open-ended network that can be in a "virtual" sense closed. It would only depend on the will or wishes of the closed user group what access is provided to whom.

The next notion which we should review is that of open system interworking. This concept, which is being actively developed in committees of both the International Standards Organization (ISO) and the International Telecommunication Union (ITU), is probably familiar to you. It involves the identification of seven distinctive levels of activity in an overall computer/communications system such that each level provides all the necessary services to permit interworking at the level above it in the model. This is an almost mind-blowing approach when one reviews the history of proprietary approaches in both the telecommunications and computer industries which tended to lock customers to one or another supplier once they were committed. The Canadian delegations of experts to ISO and ITU have been active supporters of, and contributors to, this work. It is an activity in which all end-users should, in my view, have an intense interest. It sounds like the panacea for many problems of the past. The end-product of such activity would of course be standards - networking or system protocols - which would fit the model.

> Donald Herman, President of NCR Comten, in a recent article in Communications News, compares the development of networking standards to the evolution of the Constitution of the United States.
>
> "That Constitution is as fundamental to Government as the eventual networking standards will be to the information industry...
>
> Certainly for the user and the supplier, network standards make economic sense.
>
> But standards are not only an economic necessity, they are a technological necessity."

Mr. Herman goes on to review how the industry arrived at the "current jumble of protocols and architectures" and suggests that "most of the bricks in the communications Tower of Babel were laid by the suppliers and common carriers". I feel considerable sympathy for his suggestion that the interests of users were equated with those of the supplier. However, at the same time, I recognize that, in the early tremendously dynamic days of computer/communications, the users were novices and neither had the organization, the technical sophistication

nor any way of really perceiving how they could turn this new technology to their advantage without some experience in using it. Fortunately that situation has remarkably changed and I am regularly amazed at the level of knowledge of many important users, and present company is an excellent example. Truly, many users are now in a position to powerfully express their point of view about the direction of developments affecting them. As you, the library community, exercise this prerogative, you have a dreadful dilemma. Alan Spieghman, Timeplex Inco., notes in Telecommunications:

> "Flexibility may be the single most important word in telecommunications. Anyone with experience in this business knows a network never remains the same, never becomes less complex, and never shrinks in size. The rule is ever-changing growth and sophistication. This puts great emphasis on flexibility and another concept which means essentially the same thing: compatibility."

Now I have some difficulty with the linkage: the dilemma I mentioned a moment ago is that flexibility inherently means change and change has real potential for incompatibility. It is close to being a conundrum. As users, you will want change that is responsive to some inadequacy of the system or change which accommodates in an evolutionary way your new applications or extensions of the system. You will be looking for change that is backward compatible. You will not want change that is revolutionary or requires major re-equipping or re-programming. Now, it may be argued that these factors favour a closed system where the control is more fully exercised by those to whom the telecommunications service is being provided. At the same time, your role is to serve the public and this implies an open system which will flexibly accommodate a great diversity of networks and terminal equipment.

If I may, at this point, let a little bias show, it seems to me that a closed network approach can only lead to isolation of library networks, to a self-serving system. This would be regressive, for my refreshing experience has been that libraries, particularly over the past several decades, have become places for people, rather than just places for books. It would be unfortunate if the complexity of telecommunications and computers were, figuratively speaking, to close any of the openness which has been developed.

In finishing, let me say that there are constraints which may mean that the "open-systems" which Cynthia Durrance is about to describe may not, in some places, be as open as she perceives or would wish, and that I am looking forward to learning from Look Costers that his closed system is more open than his title sounds.

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Section: INFORMATION TECHNOLOGY

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The Dutch Pica Library Automation Network

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Meeting
109/S1

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Introduction

In 1969 a number of Dutch University Libraries together with the Royal Library decided to cooperate in the area of computerized so called Library Information Systems.
After a study period it was decided in 1977 to make a practical start and develop an on line shared cataloguing system using mini computer hardware, based on the philosophy that "a publication in the Netherlands will be catalogued only once and this only in so far the title is not available from a national bibliography".
In the beginning of 1979 the first version of the Pica Shared Cataloguing System became operational and by now almost all Dutch University Libraries as well as the Royal Library and a number of large Public Libraries with scientific tasks participate in it.
Apart from the Shared Cataloguing System two other activities were initiated.
First of all Pica developed so called Local Library Systems for library management applications. The first applications available now are Circulation Control and Stack Management and Acquisitions. Local Library Systems contain separate computer systems which are located in each library and which are connected with the central Pica computer facilities.

In addition, the institutions in the Netherlands responsible for the Dutch Union Catalogue, which is now maintained as three separate cardfiles, requested Pica to assist in the development of a project plan for the computerization of the Union Catalogue. At this moment the Pica organisation is developing an On line Union Catalogue System which will provide on line search facilities aimed at library personnel but eventually also for users in general.
More over an administrative facility will be created which will support and facilitate interlibrary loan.

The Pica Shared Cataloguing System

The Pica Shared Cataloguing System is based on two DEC PDP 11/70 computer systems with shared disc drives and communication front end processors. To this system terminals were connected using leased telephone lines.

The terminals are fitted with extended character sets and operate in block-mode and for communication a polled communication protocol is used so that clusters of terminals can be operated via one telephone line. At this moment over one hundred terminals are connected to the system.

When the system became operational in 1979, the database was initially loaded with 400.000 selected OCLC titles. In addition titles have been collected from the Library of Congress and the British National Bibliography on tape and stored into the on line database.

When users are cataloguing, the first thing to do is to search the database for the availability of the bibliographic description. Searching can be performed on various keys much like other cataloguing systems.

After descriptions have been inspected and the proper one has been selected, users can add their own local information as subject heading, annotations, a user defined key, booknumber, etc. If a user is the first time user of a description he also can change the contents of it and add thesaurus-references.

He than becomes the "owner" of it and is responsible for its bibliographic quality. Other users can add their own local information but can not change the bibliographic description itself because they do not have ownership.

If no suitable bibliographic description could be selected the user can enter bibliographic information on line, together with his local information, thus creating a new bibliographic record in the database.

From the above description it is clear that the Pica-system is a shared cataloguing system, with information on different levels. First there is the general bibliographic level, which consists of the main bibliographic information and which is shared by all libraries and is accessible to all libraries. Then there is the local bibliographic level of information of which each library has its own record (for each bibliographic description one) and which is private to each library.

Within the local bibliographic level libraries can maintain information on the copy level. This information is pertinent to the specific copies and can consist of information like book number, annotation, a selection key for off line output, classification code etc.

Finally there is a fourth type of information which is not a separate level really, as it is part of the general bibliographic information. This type is the information contained in shared thesauri of which the thesaurus for names of persons is now operational.

At this moment (may 1982) the Pica database contains over 1.600.000 titles and 200.000 thesaurus-items to which about 700.000 holdings have been attached by participating libraries.

The database contains bibliographic records for all book materials, i.e. monographic, multivolume and serial descriptions, and for old and rare books and manuscripts. Facilities for non-book materials are under development.

The database is growing with about 300.000 items a year and we expect that about 500.000 holdings will be added this year.

Apart from the participating libraries which at this moment are 16 in total, also the Bureau for the Dutch National Bibliography and the Cataloguing in Publication (CIP)-bureau are using since the beginning of this year, the Pica Shared Cataloguing System for production purposes.

It is clear that this enables the libraries increasingly to use existing descriptions and that the principal of shared cataloguing is significantly supported hereby.

In addition to existing facilities, thesauri for corporate authors and subject headings were created especially for use by the National Bibliography. Eventually these thesauri will be made available to other participants as well.
Apart from the on line system an off line system has been developed which can produce various catalogue products from the database.
These products may consist of catalogue cards, COM catalogues and lists or printed catalogues.
In the design of this off line system as well as in the design of the on line system we have taken great pains to parametrise as much as possible.
At this moment a second generation of software is in production which now makes it possible by using steering parameters to produce not only catalogue cards on user specification without changing the standard software but also to produce COM- and list catalogues on a wide variety of user-specifications.
It should be noted that the facilities for COM catalogue output are of high importance to our libraries because most libraries have closed their conventional card catalogues.
Moreover a package of type setting programs have been developed with which we produce the Dutch National Bibliography in book form and with which we also can produce various catalogues in book form.
During the first 4 months of 1982 Pica produced over 1,5 million output items on cards, COM, lists or in book form.

Other systems

In the beginning of this year the first local library system was installed in the Royal Library consisting of a PDP 11/44 computer system with 28 terminals attached.
The system is used for circulation control and stack management and is now operational from april 15th this year. A second system was installed at the University of Tilburg and another three systems are expected

to be installed next year.
During the first half of 1982 the Pica Board decided for various reasons to give a high priority for the development of On line User Catalogues for the use in each individual library.
This On line User Catalogue will replace the now used COM catalogues and will provide superior facilities over conventional catalogues. In addition a connection will be made with the librarie's Circulation Control and Stack Management systems.
Although the majority of Pica libraries is supporting the development of the local library systems there are some that prefer commercial systems.
One of these, the University Library in Utrecht, is installing a GEAC Circulation Control System while a number of public libraries, in groups or on their own, are installing commercially available circulation control systems as well.
The third system of interest which is now under development is the Dutch Union Catalogue.
Based on a separate DEC PDP 11/44 system the database will be initially loaded with some 1.000.000 bibliographic descriptions. The loading of serials records will be given highest priority because a large percentage of interlibrary loan activity, is concerned with journals.
To start with, the searching facility will not provide full text searching or other sophisticated retrieval facilities but a relatively simple multi-key access mechanism with the possibility of combined keys will be provided. From our own experience and from recent publications it is clear that such facilities are sufficient in more then 90% of all cases especially if the system is serving professional library personel.
In addition to the search facility a second module will be developed which is considered to be equally important.
This module will monitor, manage and administrate inter-library loan activities and some more details about the facilities of this module are of interest.

Basically the idea is that libraries after having searched the on line catalogue for the required title and having found it, will fill in an on line interlibrary loan request form.
At the moment most interlibrary loan request are made by telex.
With the new system the terminal will take over this telex function.
All interlibrary loan requests will be collected in a disc file and twice a day this file will be processed and requests will be distributed. This distribution process is a controlled process so that a number of parameters will influence the distribution of requests.
After development started in the beginning of 1982 the installation of central computer hardware has now been completed and it is expected that loading of the database will start this summer.
In may 1983 it is expected that the system will become operational and libraries will be connected one after another.
For the first year of operation the installation of about 40 terminals is foreseen, partly connected via leased telephone lines and partly via dial-up telephone lines.
In a few years after the system becomes operational, a growth towards about 300 terminals is expected and at that moment the majority of terminals probably will be connected via the already now available packet switching network of the Dutch PTT.

Growing towards a National Automation Network

At this point in my presentation I believe that I should summarize the various components of a network as there are in the Netherlands:

- the Pica Shared Cataloguing System
- the on line Dutch Union catalogue
- the Pica developed Local Library Systems
- various other (commercially available) local library computer systems, mainly circulation control systems
- the Dutch telephone network
- the Dutch PTT's packet switching service

- the user terminals
- the libraries
- the different institutions involved, as the Dutch National Bibliography, the institutions responsible for the Dutch Union Catalogue, the Central Cataloguing organization for Public Libraries, etc.
- national and international bibliographic databases.

From this list it is clear that the development of a National Network is not a very simple task and I do believe that for the creation of such a network a step-by-step approach is necessary.

From the librarian's point of view, who is a user of the systems involved, there is first of all the Shared Cataloguing System which is being used by the cataloguing department.
In addition there is the library's own on line catalogue which has to be used by the cataloguing department, the aquisitions department and by other departments in the library.
The Circulation Control File and the Union Catalogue are used by the circulation department and also within the library facilities for interrogating national and international databases are required.
If a librarian wants to issue an interlibrary loan request it would be time saving if the central Union Catalogue System could interrogate the local library computer concerned in order to find out if the particular publication is available and if not, interrogate another local computer system etc.
Also if a cataloguer would enter or change information in the shared cataloguing system, this information should be transmitted to the Union Catalogue and to the Local Library System concerned.
The ideal situation obviously would be that a librarian can approach all these facilities from one terminal although they are located in different computer systems. He should be able to regard all pieces of information as one coherent collection in which information is consistent to all library applications.

When we look from the point of view of the librarian, I believe that it should be possible for that user to start interrogating a national or international bibliographic database in search of publications which are of interest to his purposes. After finding a list of these publications he should from the same terminal be able to interrogate his library's database. The users terminal could be within the library or outside that library but within that library's region. Interrogation of the library's database would consist of searching in the on line catalogue and in addition to have the ability to inquire about the availability of publications, make reservations and order publications as well as xerox-copies of articles from journals.

If the facilities of his local library would not be sufficient for a user he might be able to link through to the Dutch Union Catalogue and search there for the publication he requires and, after finding it, issue a request for interlibrary loan.

Although technically possible a number of problems arise related to scale and cost. If libraries would provide such services for free, it is obvious that the sky would be the limit and that very high cost indeed would result which can not be paid by libraries alone.

If on the other hand libraries would charge their users for these services the tradition of free services would be broken but also a limitation on the use of these services would be set resulting in more modest technical requirements and therefore lower overall cost.

I do believe that in the next few years some basic questions have to be answered on the policy making levels and therefore that as far as the library user is concerned for the time being he will have to deal with separate systems: the national and international bibliographic databases through an intermediar, the Local Library System from a terminal in the library and the Union Catalogue through assistance from a librarian.

From the level of libraries upwards however a National Network will grow for which a number of problems have to be solved.

- Standards have to be created for a national data structure of library information.
- Logical interfaces have to be designed for exchange of information between the different systems.
- A common overall design of the total National Network has to be agreed upon by all parties involved.
- Procedures have to be determined and agreed upon in which it is important that allowances are made for variants.
- The technical conditions have to be determined in both hardware and software.
- A management structure has to be created with sufficient power to enforce standards and interfaces.
- The financing of such a National Network has to be worked out and budgets have to be allocated for development as well as operation of the Network.

Unfortunately it is not to be expected that such a total approach on the national level will be adopted in the near future.
On the other hand Pica in its dominating position in the Netherlands can and will work into the direction of a National Network creating a basic, de facto, network which will hopefully be adopted in a later stage as the official National Network.

Also the Netherlands, as you may know, is a relatively small country with an excellent data communication network, a library tradition and a high technological level. For these reasons the Netherlands are in a unique position to actually realize, on a smaller scale than is possible in other countries and therefore relatively easier, a National Library Automation Network.
For these reasons Pica is now designing standard interfaces between its Shared Cataloguing System, the Dutch Union Catalogue and the Local Library Systems as well as communication procedures and is selecting technical solutions.

One of the first things to be done will be to give users access with one terminal to both the Shared Cataloguing System as well as the Union Catalogue by interlinking these two systems in such a way that for the user they appear as one system. For this purpose Pica is now studying the possibilities of Local Area Network (LAN) technology.

Next, links between Local Library Systems both Pica produced and commercially available ones and the centralized Shared Cataloguing System and the Union Catalogue System, should be implemented to support the following facilities:

1) maintenance of local databases by feeding information from the central database into the local database.
2) providing a so called transparency feature by which local terminals can approach the central computer systems through the local computer system.
3) communication between the Interlibrary Loan and Local Circulation Control Systems.
4) communication between Shared Cataloguing System and Local Acquisition Systems.

Finally it can be foreseen that also links with bibliographic databases and other bibliographic systems should be provided.

As I already explained to you all this can not be realized in a very short time span but I do believe that we will be able to create the basics of a National Network within four to five years.

A lot of hard but interesting work is ahead of us.

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PILOT IMPLEMENTATION OF AN OPEN LIBRARY NETWORK CONCEPT IN CANADA

by

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Meeting 109
SI

ABSTRACT

Pilot implementation of an open library network context in Canada

The development of an open library network in Canada has to take into account Canada's geographical and cultural diversity; its existing library systems and networks; and the existing and new technological developments offered by private industry and the public utilities. It will also be characterized by the cooperative and voluntary nature of the projects being undertaken. To facilitate this development, the National Library of Canada, as well as five other organizations, are participating in a pilot project using the facilities of the iNet Gateway trial being mounted by the Computer Communications Group of TransCanada Telephone System. The six organizations will be jointly conducting projects such as cataloguing, information provision, and interlibrary lending within this trial.

Introduction

I would like to speak this morning about a pilot project currently underway in Canada to test an implementation of the Open Systems Interconnection (OSI) model[1] developed by the International Organization for Standardization (ISO) for information transfer. The purpose of library involvement in this pilot project, the iNet/Gateway trial, is to test an implementation of the OSI model for library applications, and hence a model for developing a nation-wide open bibliographic and communications library network for Canada.

The environment of Canadian library network development

Development of a national network of libraries in any country must take into account the characteristics and the library traditions of that country: otherwise the chances of success will be minimal.

Certain characteristics of my country, Canada, strongly influence library network development plans here. Canada is a very large country geographically, much of which is virtually uninhabited. It spans 4½ time zones so that when it is 12:00 noon in St. John's, Newfoundland, it is only 7:30 in the morning in Vancouver, British Columbia. Because of the many time zones, and because the majority of Canada's 24,000,000 people live along its southern boundary in a corridor about 6,400 kilometers long by 1,000 kilometers wide, communications have always been of major importance. The need to deal with these geographic and demographic factors has resulted in considerable efforts being placed on the development of communications facilities, and hence Canada has been an acknowledged leader in communications technology for many years. The telephone was invented in Canada and Canadians now use the telephone more per capita than any other nation on earth.[2]

The division of powers is such in this country that while responsibility for telecommunications is shared by the federal and 10 provincial governments, responsibility for education falls solely under provincial jurisdiction. Therefore it is not surprising that we tend to favour a decentralized and regional approach for library network development over a centralized federal one.

Canada is also a bilingual country. 61% of Canadians speak English and 26% speak French as their mother tongue, but in addition, 13% of Canadians have neither English or French as a mother tongue. So, we are a bilingual and multi-cultural country.

Another important consideration is that Canada and the United States share a 6,400 kilometer border across which the people of both countries move back and forth with ease. Such close proximity to this gigantic and powerful nation has a profound effect on the nature of our society, including the nature of its libraries. Since, compared to the United States, Canada is book poor, and since many Canadian cities have closer physical proximity to American cities than to each other, in some parts of the country Canadian

libraries have nearly as many north-south links with U.S. institutions as they have east-west Canadian ones.

The development of a nation-wide library network in Canada must take into account all of these factors. Therefore any library network that is developed here must have certain essential characteristics that reflect the fabric of the country.

Essential characteristics of a Canadian library network

The network must utilize and build on the some 200 library computer systems which already exist and are constantly being enhanced. To do otherwise would be economically unjustifiable. Unlike the United States, libraries in Canada do not have access to large grants of money from public and private foundations to support library service and library systems research. We must find ways of adapting systems which already exist to the new technological environment. These systems vary from small single-function turnkey systems based on mini- or micro-computer technology to large bibliographic utilities (or closed networks) which provide sophisticated services to hundreds of libraries from a large centralized computer system. Just as this variety of existing systems must be accommodated in the network, so must existing telecommunications facilities be utilized to link them. To reinvent the wheel for libraries by trying to duplicate complex telecommunications systems already in existence in the country would be foolhardy.

The library network must be open in that it must provide a method by which an infinite number of existing and evolving systems are free to communicate with each other as required, and by which large and small systems interact as peers, rather than maintain a master/servant relationship. A Canadian library network based on the concept of openness will therefore be decentralized and comprise the sum total of all systems which follow the standardized procedures for systems interface that are being developed in conformance with the OSI model. The concept of openness also has the advantage that each library system or library network can be autonomous in its own development as long as it can translate its internal applications to interact with network standard data and control transactions. That is, the network is a feature additional to the local/regional system, to be accessed as required. The degree of local system deviation from the network standard is seen as a local responsibility, as is the cost of maintaining the conversion to the network standard. In short, the open network is viewed as evolving from a plethora of existing closed networks and systems, be they based on macro-, mini- or micro-computer hardware, which in future will be able by following standard procedures to communicate with each other. Additionally, the open network is not envisioned as being restricted to library databases, but as providing access to graphic (i.e. videotex), numerical, and textual databases. Eventually there will be standards and implementations of a similar, if not a common, command

language for accessing any of the databases within the open network as well as standardized display formats for identical categories of information. Given all of these characteristics, it is no wonder that the open network concept has generated much interest and great expectations among Canadian librarians since it provides a strategy for preserving local/provincial/regional autonomy, while permitting access to the library and information resources in the country, and abroad.

Because jurisdiction over libraries in Canada is variously the responsibility of the federal government, 10 provincial governments and hundreds of municipal governments and school boards, it is obvious that any successful nation-wide network will be voluntarily and cooperatively built, maintained, and funded. The federal government has neither the mandate nor the desire to totally fund and control such an endeavour. The federal approach is inherent in the mandate of the National Library which is "to facilitate access to the library resources of the country by the government and people of Canada". Note that the role is to "facilitate" not to "provide" that access. Faithful to this mandate, the National Library's role in network development is to coordinate the development of a bibliographic network, not to build the network per se.

Another characteristic of the nation-wide library network is that it must be bilingual and hence must be hospitable to data bases which can be queried only in English, only in French, or in either language.

We are living in a decade of rapid technological change, and a decade in which information is increasingly being viewed as a commodity which is important to a nation's economic success in world markets. Therefore, the library network must be developed to be as flexible as possible so that libraries can respond to the changing information needs of their users in a dynamic social and economic environment.

Last, but not least, any network which evolves in this country must obviously be technologically sophisticated, but at the same time affordable by the individual libraries and information systems, who will be both underwriting the costs of making their data bases available to the network, and also using other data bases which have been made available in the network. Given the world climate of economic restraint, felt in this country as in many others, this is indeed a challenge.

These, then, are the imperatives which underlie Canadian network development. Together, I think you will agree, they combine to provide a challenge to the architects of this endeavour.

Current initiatives toward realization of a nation-wide library network

Library participation in the iNet/Gateway trial being conducted by the Computer Communications Group of the TransCanada Telephone System, of which I am speaking today, is one of three simultaneous initiatives that Canadian libraries with the leadership of their National Library are taking toward the development of an open, nation-wide, computerized library network. The other initiatives are the committees of the National Library Advisory Board created to investigate network policy and management issues, and the Task Group on Computer/Communications Protocols for Bibliographic Data Interchange created to develop the applications level protocols required by the top level of the OSI model for each separate type of data application.

For discussions of these initiatives I refer you to the following papers: a speech by Dr. Sylvestre given yesterday to the IFLA General Research Libraries Division,[3] and the IFLA plenary speech to be given next Friday by Basil Stuart-Stubbs[4]. In addition, Canadian Network Papers, No. 1 and 2, by Ed Buchinski and myself respectively,[5,6] cover these topics from different aspects.

The value-added services of the intelligent network (iNet) and its gateway services for the interconnection of diverse systems have been designed within the framework of OSI. As such they have been chosen by the National Library to test the application of OSI to decentralized nation-wide bibliographic network development.

The iNet Gateway Trial: its participants

In February 1982, the Computer Communications Group (CCG) of the TransCanada Telephone System (TCTS) officially announced its iNet Gateway™ trial. The TCTS is an association of the provincially and federally regulated telephone companies of Canada of which there are nine. The Computer Communications Group is an association of the data transmission service components of all of those telephone companies within the TCTS. The trial began on July 12, 1982 and will continue for one year. It is being demonstrated at this conference at the CCG booth in a general manner, and at the National Library/ CISTI booths particularly from the point of view of libraries participating in the trial. The overall purpose of the trial is to provide the business and information communities with the environment and the tools to obtain and use computer-based information services more efficiently and effectively. CCG is conducting this trial to further define these needs and to verify value-added network service requirements. Accordingly they have recruited groups of participants to test iNet data communications services.

Participants in the trial consist of two functionally distinct groups - Common Interest Groups (CIGs) comprised of parts of a company/ organization or a group of organizations with similar information, messaging and service requirements, and Information Providers (IPs) which make information available on a profit, non-profit, or no-charge basis to members of the Common Interest Groups.

There are seven Common Interest Groups representing various industrial and service sectors: A.E. LePage (real estate), the Bibliographic Interest Group, The Bay Travel Agency, Canadian Broadcasting Corporation/Société Radio-Canada, Gulf Canada Limited (petroleum), the Ministère de la Justice du Québec (legal), and the Royal Bank of Canada. The information providers which are participating include the Canada Systems Group (CSG), Concord Publishing Ltd., the Financial Post, Info Globe, Infomart, Informatech, I.P. Sharp Associates Ltd., Novatex, the Official Airline Guide Inc., and QL Systems Ltd. The databases from these companies represent a broad range of commercially available information resources.

The Bibliographic Interest Group includes the National Library of Canada (participating in the dual role of the group coordinator and a project participant), the Canada Institute for Scientific and Technical Information (CISTI), and the libraries of Carleton University (Ontario), the Université du Québec, the University of Guelph (Ontario), and the University of Waterloo (Ontario). This membership makes it the most organizationally diverse of all the Common Interest Groups.

The main components of iNet are communication and data interchange functions and the tailoring of these functions to meet the needs of diverse organizations and users.

The iNet Gateway trial: technical components

With respect to technical components, the iNet trial provides a packet-switched interface for three kinds of terminals - alphanumeric, alphageometric (or videotex) and integrated voice/data terminals. Alphanumeric terminals include any asynchronous ASCII terminals which can interface to the public packet-switched data network called Datapac using private, leased, or dial-up lines. Videotex terminals have the fundamental capabilities outlined in the Canadian Department of Communications Telidon specifications which are compatible with those adopted in the U.S.A. These specifications describe Picture Description Instructions (PDIs) to create graphic images as opposed to the alphamosaic coding systems used by Prestel in Britain and Antiope in France. All of the videotex terminals in the iNet trial are equipped with alphanumeric keyboards for accessing the trial network-connected databases. Displayphones combine most of the features of the alphanumeric and alphageometric terminals including a split-speed modem, autodialler, data storage, soft keys, numeric keypad, full keyboard, and printer interface.

The iNet trial will support approximately 400 terminals across Canada as well and terminals in selected Canadian embassies around the world. The network access node for the trial has 80 ports to provide access for the 400 terminals. The Bibliographic Interest Group has been assigned 86 of the 400 terminals in the trial. Of these, CCG is supplying 24 alphageometric terminals and 26 Displayphones and the participants are supplying the remaining 36 alphanumeric terminals. All printers are participant-supplied.

The Network Access Node (NAN) is the iNet host computer which facilitates simplified access to multiple data bases by providing automatic access to host computer systems through a packet-switched data network(Datapac). The NAN provides an authentication service which uniquely identifies all users and controls their authorization level for access to network-connected hosts. A user administration service provides iNet operating instructions, help messages, and directory updates. Listings of accessible database and computing services are provided through three kinds of on-line directories: the public directory provides a consolidated listing of all public information services accessible through iNet; the organization directory allows database access to certain users or user groups; and lastly, the personal directory permits access to selected and often-used services via a single keystroke following iNet log-on. Each accredited user also has access to the electronic messaging system, ENVOY 100, which can be used for personal and administrative messaging as well as for specific functions such as interlibrary loan messaging. Finally, the NAN monitors and provides diagnostics and security for network-connected host computers and terminals. The network access node and the iNet-connected host systems support packet-switched data communication through implementation of CCITT X.25 or Interactive Terminal Host Interface (ITHI) support software.

CCG is underwriting the costs of some user behavioral research, the collection of traffic and other usage statistics, script development for Envoy 100 messaging services, telecommunication costs to and from the network, software and hardware for the network access node (NAN), access to the selected videotex databases, videotex user terminals, and storage and processing charges of videotex content provided by the Common Interest Groups (i.e., storage and initial loading costs). There are no continuing or contractual obligations for the participants or for the CCG after the trial is over.

Several developments similar to iNet have come to our attention, namely BIBNETT in Norway which is testing the feasibility of program-to-program communication between independently developed library systems running on different computers, and SCANNET in Scandinavia which has established a data network using advanced technology in order to provide access to more databases, especially

those with Scandinavian content. The development of EURONET/DIANE through the Commission of the European Communities combines considerable success in the creation of a telecommunications network across many national boundaries and in the provision of a wide range of databases from many sources. In the U.S.A., the Linked Authority Systems Project is implementing OSI concepts to link the Library of Congress system and two large bibliographic utilities, OCLC Inc. and RLIN. It is not incorporating other information providers at this time. Other countries may also be pursuing similar developments of which I am not yet aware. We would be pleased to be provided with information concerning similar endeavours.

Bibliographic Interest Group membership

As mentioned above, the Bibliographic Interest Group participants are the National Library, CISTI, Carleton University, the Université du Québec, the University of Guelph and the University of Waterloo.

The staff of the National Library's Office for Network Development began discussing planned trial capabilities with the CCG in the spring of 1980. By the fall of the same year, the National Library was in a position to accept the CCG's invitation to act as coordinator of a group of libraries for the trial. The Group participants were then jointly selected by the National Library and the CCG on the basis of criteria applicable at that time. Each participant had to reside within what was then the geographic area of the trial (Montreal, Ottawa, Toronto)(7) and have a stand-alone, operational and stable on-line system. The group as a whole needed to remain small in order to optimize coordinated research and development, but at the same time needed to possess as varied systems hardware as possible in order to test diverse systems interfaces (Bibliographic Interest Group members have IBM, Honeywell, CDC, DEC and GEAC systems hardware). The diversity of types of databases in terms of information coverage, language of user interaction (English and French), and function (information retrieval, cataloguing, circulation) also contributed to the final selection. Each participant needed to be willing to devote the necessary human and financial resources to participate in the trial and to agree to perform necessary data collection and evaluation tasks. In addition, preference was given to institutions that had previously expressed an interest to the National Library in developing standardized interfaces among library and information systems.

Although there are only six direct participants in the Bibliographic Interest Group, about twenty-six libraries will take part in the trial in various capacities. Several of the Bibliographic Interest Group participants have provided terminals to other libraries. CISTI has placed terminals with the National Research Council (NRC) Division of Building Research and their National Aeronautical Establishment in Ottawa; the National Library of Canada with the

Library of Parliament; the University of Guelph with the Guelph Public Library; and the University of Waterloo with the Kitchener Public Library and the Ontario Mid-Western Regional Library Centre. The Université du Québec has terminals in the libraries of five of its campuses located in five separate cities in the province of Québec. In addition, libraries in other Common Interest Groups - the Canadian Broadcasting Corporation/Société Radio-Canada, Gulf Canada Limited, and the Royal Bank of Canada - are part of the trial although not as part of the Bibliographic Interest Group. Therefore, in total, about 25 university, government, public, and special libraries are participating.

Bibliographic Interest Group host systems

The Bibliographic Interest Group hardware, software, and database resources represent the common and unique features of six separate systems, one for each participating institution. There are two federal government systems - DOBIS and CAN/OLE. DOBIS is a system jointly developed by the National Library and CISTI; its bilingual bibliographic database contains two million records on published material in all areas of knowledge. The DOBIS system resides on the National Research Council's IBM 3032 8 MB computer and supports over two hundred and fifty IBM 3270 type terminals in 10 federal government libraries accessing DOBIS via point-to-point communications facilities. An X.25 asynchronous terminal protocol converter enables ASCII terminal access to DOBIS. CISTI's scientific and technical information retrieval system, CAN/OLE, is the other federal government supported system which will be used in the trial. CAN-OLE (CANadian Online Enquiry) provides access to a wide variety of private and public sector databases (11,000,000 records) in all major fields of science and technology; requests for any document referred to in the CAN/OLE files can be generated online through the CAN/DOC service. It resides on the National Research Council's 3033 system and supports Datapac 3101 access.

The other host systems are situated in university libraries. Carleton University has its own automated system, CATSUP (Catalogue Support), allowing on-campus and dial-up access to its library catalogue database of over 500,000 records. It has just upgraded to a Honeywell Level 66 mainframe computer from a Xerox system. A Gandalf X.25 to asynchronous terminal protocol converter box will permit access to the database by trial participants. The University of Waterloo maintains a library circulation system accessible through CAM (Community Access Module) and contains an index to over 2,000,000 documents available from the campus libraries and an interlibrary loan module. The database is housed on a GEAC minicomputer; read only access will be provided during the trial using a Datapac 3000 connection. The University of Guelph system called RAM (Remote Access Module) is similar to CAM and contains information on over 1,500,000 documents. iNet participant access to RAM also is available via a Gandalf converter. The University of Guelph and the

University of Waterloo systems were interconnected for reciprocal access prior to the formation of the Bibliographic Interest Group. At the Université du Québec, an on-line union catalogue providing bibliographic data and location information for some 600,000 items is maintained for its intercampus library network of twelve libraries located on campuses throughout the province of Québec. Extensive search capabilities including Boolean logic are available for accessing this French language database called BADADUQ II (BAnque de Données à Accès Direct de l'Université du Québec). The database has just been moved from a CDC Cyber mainframe to a VAX-11/780 DEC minicomputer. Its university-wide telecommunications network connects eight computers and supports over two hundred terminals and an internal electronic messaging service for interlending. Access during the trial will be made possible through an X.25 interface.

The applications software for accessing and displaying data is unique for each of the above systems and therefore provides participants with a rich and well equipped laboratory for testing open system concepts.

The coordinating role of the National Library

In June 1981, the National Library obtained federal government approval to coordinate the participation of the Bibliographic Interest Group and funds were provided to the National Library and CISTI to participate in testing the application of new technology for the provision of library and information services.

The coordination of the Bibliographic Interest Group participation in the iNet trial has been distributed among staff of the National Library's Office for Network Development, who act as project leaders for the several projects being undertaken. They are documenting the Group's current policies, operations, and procedures relating to institutional participation in the projects; establishing and documenting common procedures as necessary for the conduct of projects; providing project management and coordination; developing methods for collecting, analyzing and reporting on data collected throughout pilot projects; and integrating participants' project results into combined reports. Office for Network Development staff are ably supported in these many faceted tasks by coordinators in each of the Bibliographic Interest Group institutions responsible for their institution's project design and implementation; and by staff in the CCG responsible for iNet as a whole and for liaison with the Bibliographic Interest Group. The excellent cooperation and flexibility shown by this sizable group in their deliberations over the pretrial period bode well for the trial's ultimate success.

Bibliographic Interest Group applications

Using iNet as a vehicle, the Bibliographic Interest Group is seeking to demonstrate the feasibility of an open network in which participants employ value-added network services to facilitate interchange of information among incompatible terminal devices and computer hardware and software operated by autonomous institutions, and in which participants follow some common procedures to facilitate access to, and promote the use of, various databases and other network resources. A total of eight projects were defined to focus the assessment of various applications. Specifically, the Group is testing the applicability of existing and emerging technology, particularly common carrier value-added networks, electronic mail, and videotex, for bibliographic data interchange applications. They are also gathering necessary preliminary planning and design data for future network development. Aspects such as potential traffic flows and volumes, operational costs, user acceptability, and the feasibility of decentralizing various functions and services are being assessed. The potential immediate benefit to the Group is expedited access to each other's host systems and databases during the trial period.

Two of the projects which are being undertaken are essential to all of the Bibliographic Interest Group members because they facilitate network-level access among the members.

Firstly, all six participants are developing and testing network interfaces and directories in order that interconnection and access to participating bibliographic systems, as well as to other information provider data bases, can take place. Presently, the Bibliographic Interest Group host systems must be accessed individually using log-on procedures which are multi-stage, detailed, and prone to delay. The iNet trial seeks to overcome this by allowing for automatic one stage log-on procedures to these systems. By connecting the Bibliographic Interest Group host systems to the iNet Gateway through Datapac, the utility of iNet-type functions and features for the provision of library services is being tested.

The second essential project is that of directories. iNet directories provide a listing of accessible systems suitably catagorized by type. The creation and utilization of these directories will allow participants to assess the extent and type of directory information and functionality that is required to support library and information applications within an open network environment. By providing information in the iNet directories of available computing resources, service descriptions, costs and conditions of use, each participant will be conducting ongoing research concerning required network access support facilities and will be assessing the adequacy of iNet security procedures. With the directory and systems interface capabilities of iNet, the process of switching from one system to another should be much more direct, efficient, and tailored to user needs.

The remaining projects support fundamental tasks performed by libraries to meet the information needs of their users - cataloguing support, information provision, and interlibrary lending.

The bibliographic data derivation project is designed to assess the usefulness of utilizing different bibliographic databases for library cataloguing support operations by enabling users to access bibliographic records maintained on unilingual and bilingual systems. Retrieved information which is displayed on a CRT will be transferred onto paper by an attached printer and the resulting screen-images assessed as to the degree of modification required before the data can be used in a given institution. Essential adjustments to content designators (i.e. tags, subfield codes, etc.) and bibliographic content will no doubt be source dependent as the iNet participants do not follow common record format and display conventions. The utility of using diverse databases for cataloguing support is being assessed by comparative analysis of search performance using on-line and off-line modes of operation; through analysis of factors such as systems capabilities, user documentation and data recording conventions which affect online search of source files; and through comparison of time and costs involved in integrating iNet-derived bibliographic data into the libraries' own files versus original cataloguing or existing data derivation methods.

As a further step toward catalogue support, the iNet trial facilities are also partially being used to assess the technical requirements for on-line file transfer of bibliographic data in accordance with Open Systems Interconnection (OSI) concepts. This involves the preparation of a prototype file transfer protocol which supports MARC record transfer within the OSI context and the iNet trial environment. The protocol specifications are being designed initially for MARC record transfer, but take videotex and electronic messaging into consideration by identifying necessary extensions which may need to be made in due course. Since this project activity complements the work of our Task Group on Computer/Communications Protocols for Bibliographic Data Interchange, the service specifications prepared were reviewed by that Task Group. Analysis of the record transfers will show a comparison of the costs and timeliness of on-line versus tape-based record transmission. This project is particularly relevant to future planning for the National Library's MARC Record Distribution Service which presently consists of a weekly tape distribution to Canadian libraries of foreign source records from the Library of Congress, the British Library, la Bibliothèque nationale, and CONSER. These source records are converted by the National Library to our national MARC format, CAN/MARC, prior to distribution.

The handling of interlibrary loan requests is another major library activity which lends itself well to new telecommunications technology.(8) Currently, interlibrary loan requests are handled mainly through mail services, telephone, and telex messages. In

addition, some libraries also use the on-line document ordering services provided by several database vendors to obtain an interlibrary loan. During the iNet trial, the Bibliographic Interest Group will utilize the electronic messaging capabilities of Envoy 100 to assess its potential to improve interlibrary loan service effectiveness. Standard interlibrary loan work forms designed for ENVOY 100 will prompt the user for specific data elements. The data elements are being determined by type of item being requested, the source of bibliographic information and the user's familiarity with the interlibrary loan procedures. Once a location for an item is found and the requisite information has been supplied, a message will be forwarded to the lending library. Potential benefits are improved timeliness of response to ILL requests by all participants; increased success in loan fulfilment due to precise knowledge of item availability; and reduced use of paper in the interlibrary loan process. Comparative statistics on the success rate of loan fulfilment, turnaround time, and cost of electronic messaging versus conventional message methods are being collected for analysis.

A project to determine the feasibility of utilizing evolving telecommunications and videotex systems to enhance the services of the participating institutions is also being conducted. Each Bibliographic Interest Group member is creating a videotex database; for example, the National Library is including a listing of Forthcoming Books, and CISTI is using videotex to display graphics from a crystallography database. The strengths and weaknesses of videotex for bibliographic applications and the cost benefit of videotex systems versus conventional bibliographic systems are being analyzed. Statistics on the usage by libraries of videotex databases are also being gathered.

The iNet resources facilitate access to the publicly available host systems and databases of the other Common Interest Groups and to those of the participating commercial Information Providers. Presently, these systems have to be accessed individually through a multi-step, system specific, log-on procedure. By providing a directory giving a complete listing of accessible systems categorized by type, as well as an automatic one-step log-on procedure, the iNet Gateway facility should provide simplified and faster access to a wide variety of bibliographic and non-bibliographic data bases and information services. Usage statistics are being collected and analyzed for aspects such as range of databases and information services accessed, cost of services provided, and user satisfaction indicators.

Although not part of the iNet trial per se, the National Library is also testing the feasibility of utilizing videodisc systems to further library service objectives. Videodisc systems and databases may improve user access to multiple types of material and potentially enhance information service provision, through either preservation and/or document supply. The National Library is producing a demonstration videodisc and is testing access to it via a microcomputer system.

CONCLUSION

We have now only 2 months' experience with the trial operation, and therefore it would be presumptuous of me to predict its results. Certainly, as in any trial of this magnitude and complexity which is dependent on utilizing the leading edge of present technology, the participants are confronting surprises both pleasant and perplexing. The Bibliographic Interest Group however is confident that valuable experience and insights are being gained into the benefits, pitfalls, and costs inherent in designing and developing a nation-wide bibliographic network which will incorporate characteristics essential for this particular country.

The iNet trial projects represent a wide range of activities which seem indispensible to the formulation of an informed design of library service provision nation-wide. In this context library service opportunities are not restricted to the information held in libraries, or to the expertise of the library staff, but rather are open to the utilization of a wide range of information and data communications services providers, each contributing crucial elements to the overall provision of library and information services.

If it proves economically justifiable for Canadians, future developments will focus on the feasibility of interconnection with library and information networks in other countries. It seems not too early for libraries to find their place in Marshall McLuhan's "global village" of information,(9) as new technological developments are quickly providing the infrastructure to turn that idea into reality.

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Problems related to interlinking online interactive library networks

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INTRODUCTION

The purpose of this paper is to demonstrate that electronic interlinking of two computerized library networks is an extremely difficult task requiring resolution of at least 36 problems of various types even when both networks are within the same country, and resolution of another 12 if the link is to be international. During the past several years interlinking has been widely discussed, but the vast majority of discussants possessed little or no understanding of the problems involved. For them, the simple question was, Why can't I get a catalog record from another network? This paper answers that question with a delineation of the unresolved problems that stand in the way of interlinkage.

Can interlinked international networks exist? The answer to this question must be "Yes," since there is no theoretical basis for "No." However, no one knows how to interlink two or more online interactive computerized library networks so that the participating libraries in one network can have access to another network and use the processes and products of the second network in the same manner as they use the processes and products of their home network. At least at the time of the writing of this paper, no such interlinking exists between or among any of the dozen networks now in being.

If such interlinking were achievable, it could provide two major benefits: 1) increase in library resources available to individual library users and 2) significant reduction in the rates of rise of per-unit library costs. Such benefits would almost surely be of sufficient magnitude to compensate for the inevitable problems, worries, and costs associated with implementation and operation of the linkage.

The paper will consider interlinkage between only two networks, because of the complexity of the hurdles to linkage of more than two. The complexity of multiple links increases according to the formula $\frac{n\ (n - 1)}{2}$ where n is the number of nodes in a network. The two library networks used in this paper's model will be treated, moreover, only in respect to their functions of online shared cataloging and online interlibrary lending based on a computerized union catalog.

Only a dozen networks exist or are about to begin operation: 1) Australian Bibliographic Network (ABN), 2) British

Library Automated Information Service (BLAISE), 3) BLCMP (Library Services) Limited, 4) Hong Kong Library Network, 5) Swedish Library Information System (LIBRIS) Network, 6) OCLC Online Computer Library Center, 7) Dutch Project of Integrated Catalogue Automation (PICA), 8) Research Library Information Network (RLIN), 9) Scottish Libraries Cooperative Automation Project (SCOLCAP), 10) Britain's South West Academic Libraries Co-operative Automation Project (SWALCAP), 11) University of Toronto Library Automation Systems (UTLAS), and 12) Washington Library Network (WLN). These 12 networks are in only seven of the world's more than a hundred and fifty nations, so that clearly interlinking all 12 would only benefit a small minority of the world's library users. It is far more likely that the extension of centralized networks internationally has a greater potential for furnishing online interactive library networking throughout the world (1).

PROBLEM AREAS

This section of the paper will discuss problems of interlinking under the headings: Political Climate, Professional Attitude, Incompatibility of Organizations, Differences in Management and Staff, Problems that Threaten Financial Stability, Telecommunication and Computerization Problems, and Concerns of Library Origins.

Political Climate

Needless to say, high stability of the political entities involved is desirable, the emphasis being on the stability of a state, not its government, for there can be frequent changes of government in some stable states. The seven areas in which networks now exist are stable, but librarians in some unstable areas are talking about establishing networks.

National politics can affect library networking and the international interlinking of networks. An understanding of national information policies in each country of involvement, particularly with respect to regulation of transborder data flow, is a prerequisite to negotiations.

Also consequential is the attitude of the national libraries, for they may aid or hinder networking and in some areas have sufficient authority to control networking.

A particularly difficult problem arises if the first network operates in a country where gratuities and gain by influence are the way of life, and the second network in a

country where bribery and graft are felonies. Detailed solutions to this type of problem are not known to the author.

Professional Attitude

The attitudes of the professional librarians involved should likewise be taken into consideration, for they may have differing priorities for the expected benefits to be generated by a computerized library network. Until recently, more librarians have been interested in increasing availability of library resources for their users than have felt the need to improve the economic viability of libraries by decelerating the rate of rise of per-unit costs, but a steady decline of financial support of libraries in absolute terms over the past dozen years has shifted emphasis from resource availability to improvement of economic well-being. This shift has already occurred in the U.S., and will probably occur in other areas as their libraries suffer diminishing financial support.

If, however, one of the linking networks has as its one and only benefit improved availability of resources, disregarding library costs, and the second network places emphases on both improvement of resources and reduction of library costs, the first network will almost certainly insist on changes in the second, in terms of sending information over the link, that will be incompatible with reducing per-unit-cost rates in libraries. Noncoincidence in benefits desired should be explored in every detail. It may well be that noncoincidence will negate linkage.

Incompatibility of Organizations

National characteristics of corporations and agencies may force cooperation between very different types of organizations, the extreme being cooperation between a governmental agency and a private corporation, which is notoriously difficult even within a country. Although a governmental agency may enjoy greater stability than a private network, its subjection to governmental interpretation of national information policies and its inherent bureaucratic rigidities can present many hurdles to cooperation. The private network, while freer to be more businesslike, flexible, and innovative, may be perceived by the governmental agency as potentially unstable or undesirable to work with.

The British Post Office expressed such undesirability during several years in the 1970's when it refused to allow

Britains to access via TYMNET private databases in the United States, although they were permitted to access databases at the National Library of Medicine. Similarly, the National Library of Canada expressed itself as unwilling to work with OCLC, a private, not-for-profit corporation, because OCLC was neither a governmental agency nor a foundation.

Differences in Management and Staff

Differences in type of management and quality of personnel can engender problems that should be neutralized or resolved in the negotiation preceding interlinkage. One or both networks, for example, may have a board of trustees or directors, or even an advisory board, so deeply involved in management that management is hampered and governance, advice, and counsel suffer. Given the many hurdles along the road to negotiating an interlinkage agreement, it is undesirable to have negotiations carried out between boards, or between the board of one network and the management of another.

It is important for each network contemplating linkage to compare the quality of its management and technical personnel with that of the other. If one is vastly inferior in terms of management competence and technical proficiency, there will be difficulties in both initial linkage and continued operation for which there will be no ready resolution.

Problems that Threaten Financial Stability

The financial problems associated with international interlinkage are multitudinous. Positive steps can and must be taken to solve these problems or neutralize their effects, but in some cases they may be so severe as to make international operation uncertain of success.

One troublesome problem is the fluctuation of international exchange rates in a world of free-floating currencies (2). Fortunately, forward hedges available from banks enable a network operating internationally to stablize the exchange rate for at least up to 18 months if necessary. Forward hedges for shorter periods of time, although they carry some cost, also guarantee stabilization of rate of exchange. There are several other solutions to the exchange risk problem, even that of taking no action whatsoever when only small amounts of money are involved.

High inflation and interest rates are two sources of financial calamity, particularly if one of the library networks operates in a country with relatively low rates. While for-profit businesses operating internationally have successfully employed a variety of techniques for neutralizing high interest and inflation rates, there are some areas of the world in which even experienced businesses have decided that the risk is too great to initiate or continue operations. Library networks considering activity in areas of inflation and high interest rates should exercise utmost caution to insulate themselves against the deleterious effects of those conditions.

Financing of the interlinkage must be firmly determined early in negotiations. If financing is to be external to the networks, charges for using the links must be agreed upon. If the link is subsidized, so that there are no charges or charges that only partially support the link, provision should be made during negotiations for support of the link should subsidization be withdrawn.

Financial instability in one or both networks contemplating linkage will probably be exacerbated if linkage is undertaken. Financial instability of an organization is characterized by occasional props being necessary to keep the organization alive. They take the form of grants of money, noninterest loans, prepayments extending over more than one year, assignment of outside personnel, and furnishing, without reimbursement, space, light, and heat. These supports can disappear, and if instability continues the original benefits of the linkage will also disappear.

Each network must thoroughly evaluate the financial health of the other in considering an interlinkage agreement. If the two parties do not enjoy approximately equal financial health, the one less stable financially will drag down the other. A section can be included in the agreement to protect each party from such an event, but almost certainly financial disequilibrium will begin to occur before the protective section is invoked.

Competition can adversely affect financial health. The effect of competition on a network in its own region, and particularly the effect of competition within the region of its projected associate, is another area of careful evaluation. It is particularly important to be informed of the liklihood of a competitor being about to produce a new development that would heighten competition. In this connection it should be

noted that perceived competition can be just as effective as real competition and that it often takes the form of waiting, sometimes for years. to see what a national library or national commission will do.

Each network should also have access to the other's reports, published and otherwise, containing information usually found in printed annual reports of private corporations. These reports should contain sufficient information so that one network can evaluate the stability of the other. In the case of a not-for-profit corporation, it should be possible to evaluate its ability to cover overheads, rising wages, and acquisition of new machines. Reports of a private corporation should contain information adequate to evaluate its ability to grow financially, commercially, and humanly.

Each party, whether governmental or private, should make available to the other audited financial statements at least for the most recent year and preferably for the last five years. If one of the parties does not have audited financial statements of its operation, it should retain the services of an independent international firm of accountants and auditors to prepare such statements. These financial statements should be in sufficient detail to make it possible to determine cash flow, generally accepted business ratios, and sources of income, including stability of appropriations if the party is a government agency.

Sources and amounts of capital available should be in the statements. Other financially relevant information should include description of plant, machines and equipment, as well as a layout of physical arrangement.

Interlinkage can contain a subtle threat to the existence of one network if the other network has a system easier to use or a much larger database. Libraries participating in the less efficient network may slowly migrate to the other without specific intention to do so, ultimately reducing the revenue of the first network to a level that could threaten its continued existence. The solution to this problem lies in a system of pricing for linkage use that protects the revenues of both networks.

Telecommunication and Computerization Problems

Technical problems include unreliability and instability of electric power sources, lack of uniformity of characteristics of electric power, differing transmission speeds,

different prices for telecommunication services, inefficient design of hardware and software of an online system, lack of efficiency and stability of the online system of each network, and unavailability of personnel with high expertise.

An absence of a standard for communication of MARC records by telecommunication presents a major hurdle to linkage. Records formated for display on a terminal rather than in standard MARC format are used by most, if not all, networks communicating catalog records. Before design of the linkage can be undertaken, there must be an answer to the question: What will network A transmit to which equipment in network B? If communication is to be from computer A to Computer B, the format of the record may very well be different from the format of the record were transmission to be from Computer A to a terminal in network B via computer B serving purely as a telecommunication device. A thorough and detailed design analysis to attain the highest efficiency must precede linkage.

Access protocols are so notoriously different as to appear to be eccentric, but it is certain that most computer networks cannot accept searches and instructions from other networks without extensive reprogramming. A uniform command language would permit access to any network, but the EURONET Common Command Language did not remain common for much more than a year, two divergent languages having evolved in that short time (3). It appears unlikely that an international uniform command language will be successful until a language is developed comparable to that of international road signs.

There are two basically different organizations of search key indexes to computerized catalogs, namely precoordination and postcoordination. In precoordination the elements of search keys are coordinated within the computerized index, in postcoordination by terminal operator. Although there is no way by which users of a network based on postcoordinated search keys could search via a link on a network using precoordinated search techniques, relatively minor programming could be installed in a postcoordinated search system to accept most, but not all, of the search keys designed for precoordinated searching. Postcoordination does, however, allow the operator to correlate the results of two or more searches.

Concerns of Library Origin

The system of national bibliographies and national MARC files does not correspond to collections of publications and catalogs thereof in libraries. Libraries organize their collections and catalogs on a universal basis without regard to the origin of their materials; almost without exception, they do not organize catalogs and collections on a national basis. Aspects of universalism and internationalism in terms of aggregates of national bibliographies have been discussed elsewhere (4), but it is obvious that an aggregate of existing national MARC files will not equal the universalism of any large library. National MARC files alone would be totally inadequate as bases for interlinked networks.

Differing cataloging rules are a source of major problems in interlinkage. Two sets of cataloging rules can range from outright incompatibility to exasperatingly close accord. The German Instruktionen für die alphabetischen Kataloge der preussischen Bibliotheken (PI) (5) and the Regeln für die alphabetische Katalogisierung (RAK) (6) are entirely incompatible. A library employing PI and participating in a network using RAK would in effect have to do the descriptive cataloging of each item twice. An example of close accord is the first edition of Anglo-American Cataloging Rules (AACR) and the second edition (AACR2) (7). A library using AACR2 and participating in a network based on AACR would have to do extra work in descriptive cataloging, but not nearly to the extent as in the case of PI and RAK. In between these two examples is the situation posed by RAK and AACR2. Although based on the same principles, they present significant differences that would require special programming to provide efficient shared cataloging.

The Universal MARC Format (UNIMARC) does not resolve the problems presented in the previous paragraph. UNIMARC is essentially a uniform physical format logically analogous to the 75 x 125 millimeter catalog card. UNIMARC, like catalog cards, can contain catalog entries incompatible for arrangement in one catalog.

Problems of varying degrees of seriousness will arise from other differences: in cataloging quality control procedures, in traditions of copy cataloging, and in compatibility of interlibrary loan systems; or when the MARC format employed in one database is incompatible with the format employed in the other. Another database problem arises when one network maintains online only the last year or two of its national MARC file, while the other maintains a large universal file.

A network design which sees libraries as integrated systems cannot be linked successfully with a network that treats libraries as traditional configurations of unrelated procedures and files. If a system point of view is absent from both networks, neither is likely to benefit from interlinkage.

An analogous dislocation in points of view occurs when one network group of participants emphasizes cataloging of individual items with disregard for economy, whereas the participants in the second network give high priority to the economic viability of libraries. The point was made earlier, but should be reemphasized here: if one network has little desire to achieve cost benefits, linkage should not take place.

The interlinking of networks should increase availability of library resources to individual library users. If it will not, there is little or no point in undertaking it. For the library to conduct its own successful searches, the design of online local public catalogs of the two linked systems must be compatible (8). Searches should produce information for the user on local library holdings, holdings throughout the nation, and international holdings. If they do not, no real benefit will accrue to users.

CONCLUSION

Although the examination of interlinkage in this paper involves only two networks, and is limited to shared cataloging, online union catalogs, and interlibrary lending, it contains 48 discrete problems of which 12 stem from international activity. These 48 problems and questions should be resolved, answered, or at the very least recognized, before two networks can negotiate an effective agreement. There are four of utmost importance; if any one is unresolvable, an effective agreement cannot be reached. They are

1. Disparate competence of personnel
   If one or both networks have incompetent management or technical personnel, an agreement should not be consummated.

2. Lack of audited balance sheets and operating statements
   There is too much risk involved to enter into an agreement when financial statements are unavailable.

3. Extensive incompatibility of descriptive cataloging rules

4. Unilateral prohibition of transborder data flow
   A few countries practically prohibit flow of data out of the country while being anxious to attain an inward flow. No agreement should be consummated when this situation exists, partially or completely.

In the remaining 44 problems, there are conjunctions of two or more that, if unresolvable, would also constitute an effective barrier to consummation of an agreement.

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